Space Weather Technical Forecast

Issued on Wednesday, 09 August 2023 at 01:12 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chances of further S1 enhancements gradually declining. Risk of R1/R2 reducing after midweek.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate in the past 24 hours, peaking with an M3.6 flare from AR3387 in the northwest at 08/0931 UTC. There are currently nine sunspot regions on the visible disc, with two small unnumbered regions, and the majority now either small, stable and unipolar, else bipolar and in decay. AR3387 in the northwest is now the most noteworthy on the disc, with a Dsi/Beta-Gamma configuration, although this region is becoming more difficult to analyse as it continues to rotate closer to the limb, following close behind ex-3386, with at least some magnetic connection over the limb. AR3395 in the northeast has shown some minor growth in its periphery spots surrounding its penumbral central spot. No Earth-directed CMEs have been observed in available coronagraph imagery in the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as measured at L1 by ACE and DSCOVR, was indicative of weak CME influence, with a transient feature arriving at the start of the period. Solar winds have been slightly elevated, near or just above 500km/s, before a steady decline to near 450km/s at present. The solar density has been mostly average throughout. The IMF has been weak to moderate, due to waning CME influences, peaking at 8nT, with the all important north-south component (Bz) varying between +4 and -6nT. The phi angle varied between negative (towards the Sun) to positive (away from the Sun), where it remains more stable at present. The net effect of the above solar wind parameters was for mostly Quiet conditions (Kp1-2), with an Active (Kp 4) interval observed at the start of the period (08/0000-0300UTC) due to weak CME influence.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10 MeV) proton flux showed a response to the X1.5 flare peaking at 07/2046UTC from Ex-AR3386 (which as now rotated beyond the NW limb). This breached S1, Minor Solar Radiation storm levels at 08/0100UTC, peaking at 45 pfu at 08/1720 UTC. High energy (greater than 2MeV) electron flux was initially at background levels, rising to Moderate levels, with a peak of 720 pfu at 08/1720 UTC, during its diurnal cycle. The associated 24-hour integrated fluence remained well below the Active level (1e8 integrated pfu), with 2.21e7 integrated pfu recorded at 09/0001UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Further M-class flares are Likely early on day 1 (09 Aug) from AR3387 in the northwest, although the risk gradually reducing as this region departs from the disc. Activity should then decline to Low, with a Chance of rising to Moderate each day, with any contribution from regions arriving from around the eastern limb.

Solar Wind / Geomagnetic Activity: No coronal hole fast winds feature in the forecast, and there have been no new modelled Earth-directed CMEs in the past 24 hours. Geomagnetic activity should be mostly Quiet throughout the period.

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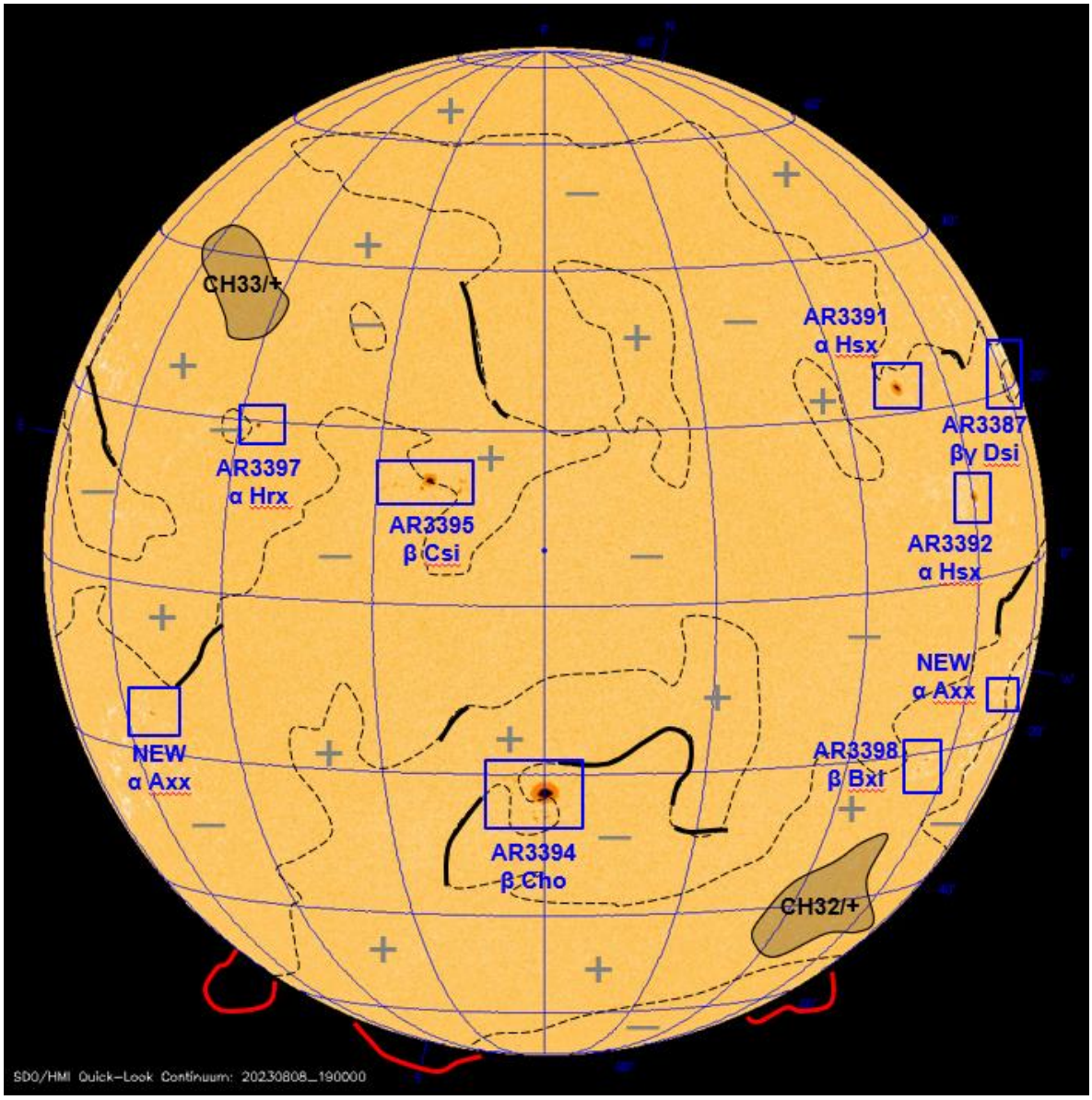
Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux should show a decreasing risk of further breaches of S1 as the primarily responsible region rotates further around the far side, falling from Expected to a near background. Slight Chance by the second half of the current UTC working week. 1pfu 100MeV enhancements and 10MeV enhancements as high as S3 appear unlikely throughout. The high energy (greater than 2 MeV) electron flux carry a Chance of rising to High after midweek UTC once any CME influence recedes. The associated fluence is expected to remain below Active, but with a weak rising trend later in the period.

Figure 1. Solar Analysis Valid 08/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

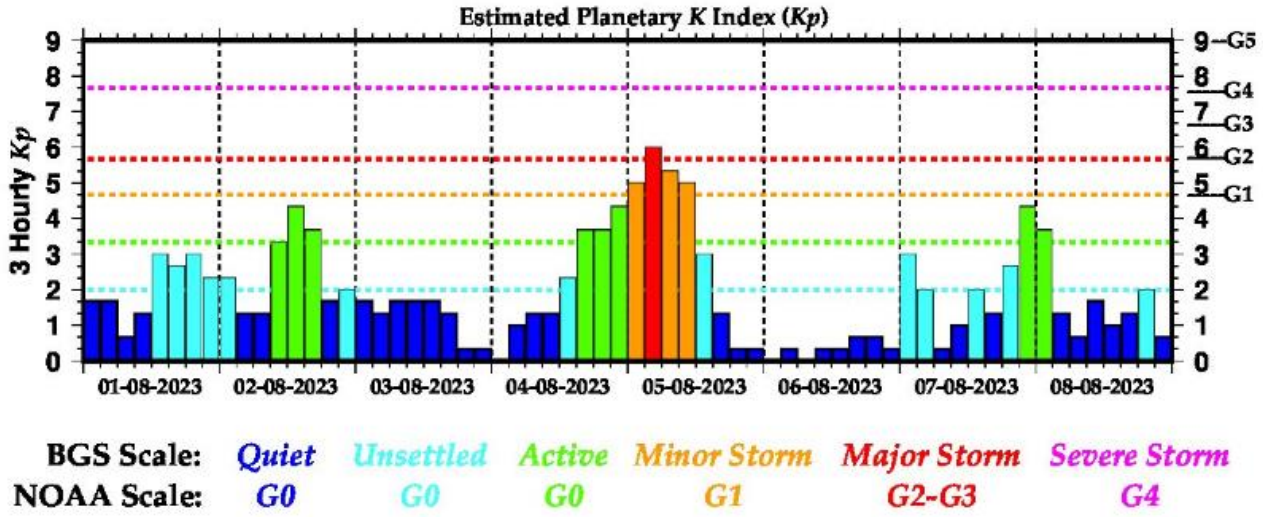
No significant coronal hole fast winds are anticipated in the coming four days, with no further Earth-directed CMEs currently in the forecast. However, a couple of glancing blow CMEs were due to arrive at Earth late on the 08 Aug, although there is no evidence visible at STEREO-A on MAG and PLASTIC instruments despite being at 0.95AU. Therefore, these are now considered to have missed Earth with no impacts expected. As a result, geomagnetic activity is likely to be mostly Quiet throughout, with the slight chance of isolated Unsettled intervals, as solar winds gradually decline towards background levels.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

No Earth-directed CMEs have been observed in the past 24 hours.

Figure 2: BGS Estimated Planetary K Index (Kp).



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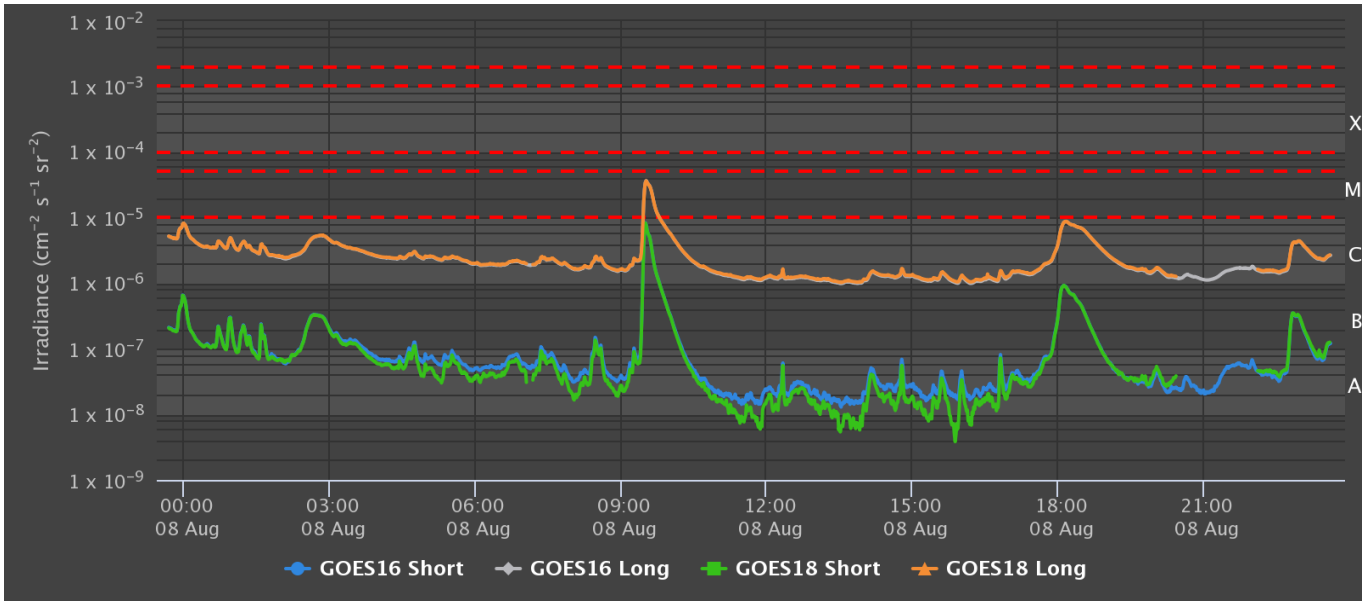
Radio Blackouts - X-Ray Flares:
Solar activity has been Moderate in the past 24 hours, with an M3.6 flare, peaking at 08/0931 UTC from AR3387 in the northwest. This region is becoming more difficult to analyse as it continues to rotate closer to the northwest limb, following Ex-AR3386, but maintains its Dsi/Beta-Gamma configuration. The risk of further M-class flares from AR3387 falls from Likely to a Chance after midweek, with any corrective contribution from the eastern limb remains to be seen.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	50	40	30	30
Very Active	R3 to R5 X Class	No	5	1	1	1

Figure 3: GOES16-18 X-Ray Flares.



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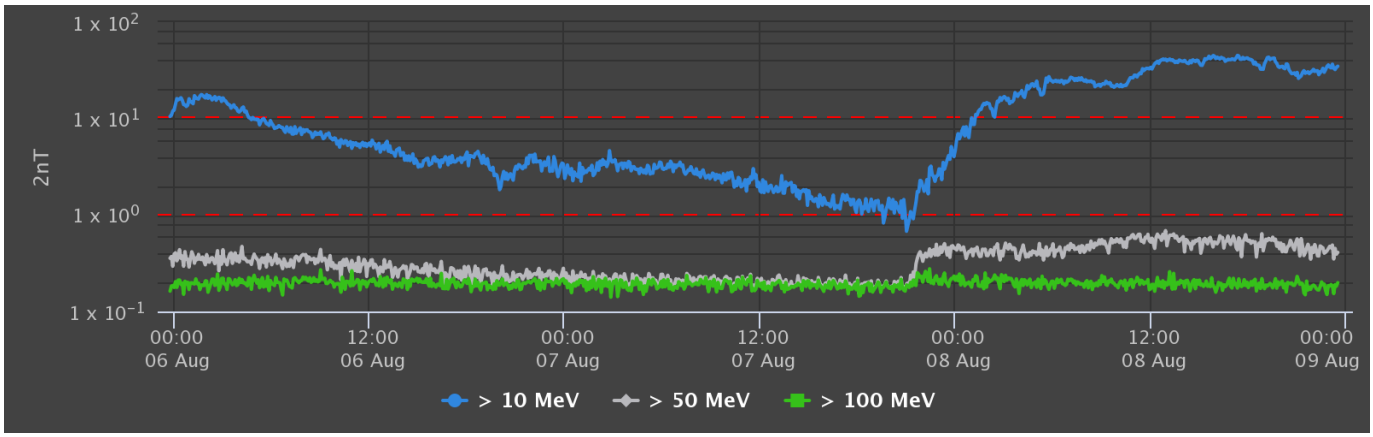
Solar Radiation Storms - (High Energy Protons):
Further flares from Ex-AR3386 could enhance levels further over the remainder of day one and over midweek, however the region should then be sufficiently far round the far-side to limit the risk of further notable proton enhancements. It is also worth noting that while there is no history to speak of, AR3387 may also serve to enhance levels should it continue its habit of producing M-class flare activity as it approaches the limb.

S1 solar radiation storms are Expected to remain ongoing for the coming twelve hours or so, but the risk should lower to a Chance by midweek, and Slight Chance later in the UTC working week as the regions responsible rotate further from view.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	Yes	100	50	10	5
Very Active	**≥ S3 ***	No	5	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: GOES-16 Proton flux – past 3 days shows the current S1 radiation storm on-going, after recent notable flare events.



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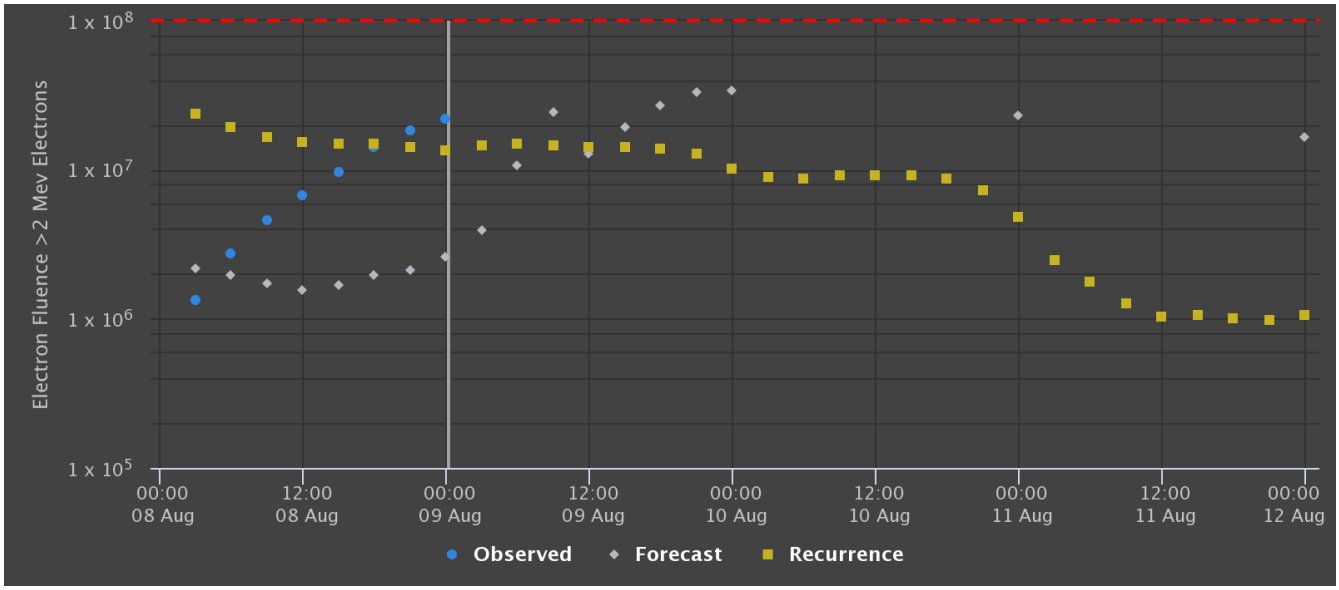
High Energy Electrons Event (≥ 2MeV):
The high energy electron flux (greater than 10 MeV) observed by GOES16 showed a slight recovery in the 24-hour period, however with no fast winds expected, only a modest flux rise during the diurnal cycle is expected, with confidence remaining low.

Overall, the associated 24-hour integrated fluence is likely to stay below the Active level, with perhaps a peak Chance later this working week. Given the recent presence of CMEs and the possibility of further such enhancements, REFM is not considered to be able to provide useful guidance in this case, further lowering confidence.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	20	30	30	30
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: MOSWOC REFM – electron fluence.



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